

# HPSR 2002

Workshop on High Performance Switching and Routing

*Merging Optical and IP technologies*



<http://www.ieice.org/hpsr2002>

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In cooperation with the Technical Committee on Information Networks, IEICE  
and the Technical Committee on Network Systems, IEICE

May 26 - 29, 2002

Kobe, Japan





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## Call for Participants

2002 Workshop

on High Performance Switching and Routing

(HPSR 2002)

May 26-29, 2002

Kobe, Hyogo pref. JAPAN

<http://www.ieice.org/hpsr2002>



The ATM Forum



**The 2002 Workshop on High Performance Switching and Routing (HPSR 2002)** will be held in Kobe, Hyogo Prefecture, Japan.

A historical port town, foreign visitors are likely to feel right at home in Kobe. In recent years, Kobe has achieved a high optical fiber diffusion rate.

Topics on Kobe can be found at Kobe's Web site below.

<http://www.city.kobe.jp/index-e.html>

The scope of the workshops has been continually expanded to include switching and routing aspects of IP, optical networks, and wireless communications. A simple solution for the explosion of Internet traffic is high-speed switches and routers. In addition, recent IP networks need better quality-of-service (QoS) and flexibility. These approaches will be the focus of the workshops.

The 2002 Workshop will include invited speeches by outstanding persons presentations on original research, a day of tutorials, and an interactive demo.

An Interactive Demo is organized during the HPSR2002 workshop. This event will offer companies and researchers a great opportunity to present their activities and demonstrate their research/products interactively. Any type of demonstrations will be possible, such as a video demonstration, a real demonstration.

The purpose of the conference is to share research, experiences, and ideas among researchers, developers, and service providers in the field of data, voice and multimedia communications using IP and other high-speed switching and routing technologies. Original papers will be presented on such topics as (but not limited to):

- High-speed Internet Backbone
- IP/WDM integration
- ATM networks
- Optical networks
- Next Generation Mobile Network
- Gigabit/terabit routers
- ATM/IP integration
- MPLS and GMPLS
- Programmable networks
- 3G/4G network evolution
- Routing and signaling protocols
- Traffic engineering and control
- Quality of service
- Performance measurement and evaluation
- Terminals
- Network management and operations
- Tariffing, accounting, and charging

# Welcome Message from the Technical Program Committee Co-Chairs

## TPC Co-chairs



Naoaki Yamanaka



Thomas Chen



Heinrich J. Stuetzgen

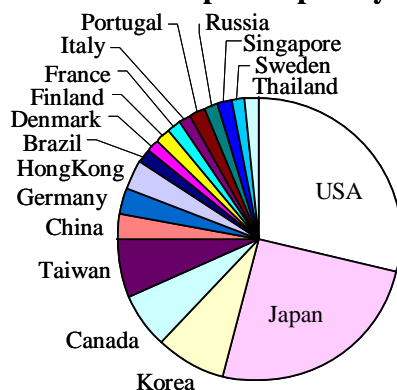
On behalf of the Technical Program Committee, it is our great pleasure to welcome you to the 8<sup>th</sup> Workshop on High Performance Switching and Routing in Kobe, Japan.

This workshop is one of the largest and best established workshops in the area of high speed communications. This year is the eighth anniversary since 1995, and the 3<sup>rd</sup> workshop after its name was changed from ATM to High Performance Switching and Routing. The workshop has been alternating among North America, Europe, and Asia.

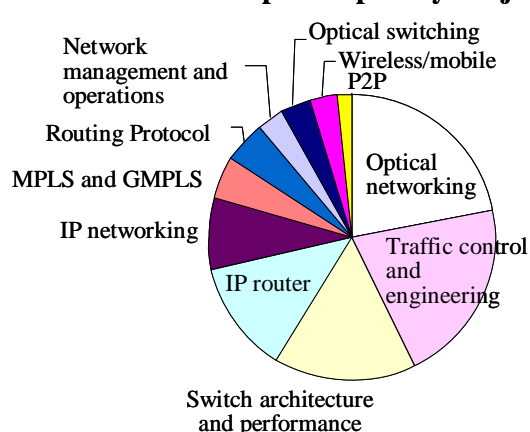
We have been delighted by the overwhelming response, especially since we were initially worried about the influence of the current economic downturn as well as the effects of the September 11<sup>th</sup> attack on the participation in international conferences. Despite all that, over 110 contributions were submitted for the Technical Sessions from 20 countries. After more than 300 individual reviews performed by the TPC members and other experts, 63 submissions were accepted for presentation at the conference. The 63 submissions consist of 45 regular presentations and 18 poster presentations. In addition the program includes 4 half-day tutorials, 1 keynote speech, and 2 invited talks. As shown below, an almost equal number of contributions has been accepted from North America, Europe, and Asia. One notable trend in the program is, that, whereas until four years ago there were many performance evaluation papers, we now see more papers on optical networking and technologies such as IP and MPLS. However, as in the past, many high quality papers on performance evaluation and traffic control are also included in the program. Furthermore, we have grouped 18 papers that will stimulate face-to-face discussions into a special poster session. These poster sessions have been provided with sufficient time so that your questions, comments and suggestions, can be raised.

On behalf of the entire program committee, we hope this workshop will contribute to the further advancement of high performance switching and routing technologies. We hope that the program will stimulate many new ideas and that you will make many new contacts during the discussions as well as at the social events. Please enjoy yourself at the workshop and don't forget to take a closer look at the city of Kobe and its surroundings.

### Distribution of Accepted Papers by Country



### Distribution of Accepted Papers by Subject



## HPSR2002 Technical Program At-A-Glance

	Sunday, 26 May		Monday, 27 May		Tuesday, 28 May		Wednesday, 29 May	
8:30 am			8:30 am to 9:15 am (Room A) Opening Welcome Remarks Prof. T. Aoyama Program Overview Dr. N. Yamanaka		8:30 am to 9:15 am (Room A) Invited Speech I Dr. K. Sato		8:30 am to 10:00 am Session 4A (Room A) Diff-Serv/ IP QoS	8:30 am to 10:00 am Session 4B (Room B) Optical Switch
9:15 am			9:15 am to 10:00am (Room A) Keynote Dr. C.G. Gunner		9:15 am to 10:00am (Room A) Invited Speech II Prof. Nick McKeown			
10:00 am			10:00 am to 10:30 am Break		10:00 am to 10:30 am Break		10:00 am to 10:30 am Break	
10:30 am			10:30 am to 12:30 pm (Room A) Hot Topics Session		10:30 am to 12:00 pm Session 3A (Room A) Optical Internet/ GMPLS	10:30 am to 12:00 pm Session 3B (Room B) Switch Router Architecture	10:30 am to 12:00 pm Session 5A (Room A) TCP/IP Flow Control	10:30 am to 12:00 pm Session 5B (Room B) Switch Architecture /Scheduling II
12:00 pm	*International Conference Center				12:00 pm to 1:30 pm Lunch		12:00 pm to 1:00 pm (Room A) Closing	
12:30 pm	12:30 pm to 3:30 pm	12:30 pm to 3:30 pm	12:30 pm to 2:00 pm Lunch					
1:00 pm	Tutorial 1 on Scheduling Algorithms for Input-queued	Tutorial 2 on Peer-to-peer Communications Dr. T. Hoshiai			1:30 pm to 3:00 pm (Room A) Panel Discussion Next Generation Mobile Internet Technology Prof. T. Hattori		1:00 pm to 5:00 pm Technical Visit  ++++ 1:30-5:15 PM Workshop on Photonic Switching	
1:30 pm								
2:00 pm	IP Routers Prof. M. Ajmore Marsan and Dr. P. Giaccone		2:00 pm to 3:30 pm Session 1A (Room A) IP Routing and Traffic Control	2:00 pm to 3:30 pm Session 1B (Room B) Switch Architecture/ Scheduling I				
3:00 pm								
3:30 pm	3:30 pm to 4:00 pm Break		3:30 pm to 4:00 pm Break		3:00 - 3:15 PM (Room A) Interactive Demo Overview	*Sponsored by Technical Committee on Photonic Switching, the IEICE *Meeting uses Japanese language only. *Site: Meeting room 3 in KCCI building. *See brochure at HPSR2002 desk. ++++		
4:00 pm	4:00 pm to 7:00 pm Tutorial 3 on Mobile Internet and Next Generation Wireless Networks Prof. A. Jamalipour	4:00 pm to 7:00 pm Tutorial 4 on IP over WDM Prof. H. T. Mouftah	4:00 pm to 5:30pm Session 2A (Room A) Optical Protection/ Routing	4:00 pm to 5:30 pm Session 2B (Room B) IP Table Lookup	3:15 pm to 5:00 pm (Event Hall) Poster Session			
5:00 pm			5:30 pm to 6:00 pm Break					
5:30 pm								
6:00 pm			6:00 pm to 7:00 (Room A) The ATM Forum Dr. Richard A. Sweatt					
6:30 pm								
7:00 pm			7:00 pm to 8:30 pm Reception (Portopia Hotel)		7:00 pm to 10:30 pm Banquet (Portopia Hotel) *Towards Next Generation Internet *HPSR 2002 Award Ceremony *HPSR 2003 in Torino, Italy			
8:30 pm								
10:30 pm								

# Monday, May 27, 2002

## Opening, 8:30 – 9:15 AM (Room A)

Chair: Prof. Kenichi Kitami, Tokyo University of Technology, Japan, Organizing Committee Chair

### Welcome Remarks

Prof. Tomonori Aoyama, University of Tokyo, The General Chair of the HPSR2002

### Program overview

Dr. Naoaki Yamanaka, NTT Network Innovation Laboratories, NTT Corporation,  
Technical Program Committee Co-Chair

## Keynote, 9:15 – 10:00 AM (Room A)

### Building a Reliable and Scalable Internet: Applications, Equipment, and Technology

Dr. Christopher Gunner, Senior Vice-President Research and Development, Avici Systems, USA

## Hot Topics Session, 10:30 AM – 12:30 PM (Room A)

Chair: Dr. Heinrich J. Stuetzgen, NEC Europe, Germany

- H-1: Design and Analysis of 100% Resilient All-optical WDM Networks Based on Mesh and Multi-ring Approaches Using Joint Optimization Technique  
*Charoenchai Boworntummarat, Pornchai Thanakomsakorn, Wasan Tirasirikul, Lunchakorn Wuttisittikulkij and Sak Segkhoonthod, Chulalongkorn University, Thailand*
- H-2: Criticality Avoidance Routing in Dynamic Wavelength-Routed Optical Networks  
*Pin-Han Ho, Hussein and T. Mouftah, Queen's University, Canada*
- H-3: Permutation in Rearrangeable Nonblocking Optical MINs with Zero First-Order Switching-Element-Crosstalk  
*Xiaohong Jiang, Md. Mamun-ur-Rashid Khandker, Hong Shen and Susumu Horiguchi, Japan Advanced Institute of Science and Technology, Japan*
- H-4: Development of the Photonic MPLS Router to Integrate Optical and IP Networks  
*Satoru Okamoto, Katsushi Shimano and Akio Sahara, NTT Corporation, Japan*
- H-5: Scheduling of Multicast Traffic in High-Capacity Packet Switches  
*Aleksandra Smiljanić, AT&T Laboratories, USA*

## Session 1A: IP Routing and Traffic Control

2:00 – 3:30 PM (Room A)

Chair: Prof. Abbas Jamalipour,

University of Sydney, Australia

- 1A-1: Adaptive CSFQ: A New Fair Queuing Mechanism for SCORE Networks  
*Masayoshi Nabeshima, NTT Corporation, Japan*
- 1A-2: Inter-domain Routing Stability Measurement  
*Yong Jiang<sup>1</sup>, Avri Doria<sup>2</sup>, Daniel Olsson<sup>3</sup> and Fredrik Pettersson<sup>3</sup>, <sup>1</sup>Telia Research, Sweden, <sup>2</sup>Lulea University of Technology, Sweden, <sup>3</sup>Opearax AB, Sweden*
- 1A-3: A High-Speed Novel Fair Buffer Allocation for ATM-GFR Services in TCP/IP Internetworks  
*Po-Chou Lin, Chunghwa Telecom, Taiwan, and Chung-Ju Chang, National Chiao Tung University, Taiwan*
- 1A-4: A Routing Coordination Protocol in a Loosely-Coupled Massively Parallel Router  
*Myongsu Choe<sup>1</sup>, Jack Wybenga<sup>2</sup>, Byung Chang Kang<sup>1</sup> and Azzedine Boukerche<sup>3</sup>, <sup>1</sup>Samsung Electronics, Korea, <sup>2</sup>Samsung Telecommunications America, USA, <sup>3</sup>University of North of Texas, USA*

## Session 1B: Switch Architecture/Scheduling I

2:00 – 3:30 PM (Room B)

Chair: Dr. Peter Y. Yan, Erlang Technology, USA

- 1B-1: The Dual Round Robin Matching Switch with Exhaustive Service  
*Yihan Li, Shivendra Panwar and H. Jonathan Chao, Polytechnic University, USA*
- 1B-2: The Dual Round Robin Pseudo-grant Matching for High-speed Packet Switches  
*R. Manivasakan, Mounir Hamdi and Danny H.K. Tsang, Hong Kong University of Science and Technology, Hong Kong*
- 1B-3: Frame-Based Matching Algorithms for Input-Queued Switches  
*A. Bianco<sup>1</sup>, M. Franceschini<sup>1</sup>, S. Ghisolfi<sup>1</sup>, A. M. Hill<sup>2</sup>, E. Leonardi<sup>1</sup>, F. Neri<sup>1</sup> and R. Webb<sup>2</sup>, <sup>1</sup>Politecnico di Torino, Italy, <sup>2</sup>BT Advanced Communications Research, UK*
- 1B-4: Packet Latency Optimization for VOQs in Variable-Length Packet Switches  
*Viet L. Do and Kenneth Y. Yun, University of California, San Diego, USA*

## Monday, May 27, 2002

### **Session 2A: Optical Protection/Routing 4:00 – 5:30 PM (Room A)**

*Chair: Dr. Soichiro Araki, NEC Corporation, Japan*

- 2A-1: Multi-Domain Mesh Optical Network Protection Using Hamiltonian Cycles  
*Hong Huang and John A. Copeland, Georgia Institute of Technology, USA*
- 2A-2: A Disjoint Path Selection Scheme with SRLG in GMPLS Networks  
*Eiji Oki, Nobuaki Matsuura, Kohei Shiimoto and Naoaki Yamanaka, NTT Corporation*
- 2A-3: Flow Splitting Approach for Path Provisioning and Path Protection Problems  
*Rauf Izmailov, NEC USA, USA, and Dragos Niculescu, Rutgers University, USA*
- 2A-4: Architecture and Functional Requirements of Control Planes for Automatic Switched Optical Networks: Experience of the IST Project LION  
*Katsuhiko Shimano<sup>1</sup>, Carlo Cavazzoni<sup>2</sup>, Alessandro D'Alessandro<sup>2</sup> and Antonio Manzalini<sup>2</sup>, <sup>1</sup>NTT Corporation, Japan, <sup>2</sup>Telecom Italia Lab., Italy*

### **Session 2B: IP Table Lookup 4:00 – 5:30 PM (Room B)**

*Chair: Prof. Kenneth Yun, University of California, San Diego/AMCC, USA*

- 2B-1: Novel Hardware Architecture for Fast Address Lookups  
*Pronita Mehrotra and Paul D. Franzon, North Carolina State University, USA*
- 2B-2: Performance Prediction Method for IP Lookup Algorithms  
*Ryo Kawabe<sup>1</sup>, Shingo Ata<sup>2</sup>, Masayuki Murata<sup>1</sup>, Masanori Uga<sup>3</sup>, Kohei Shiimoto<sup>3</sup> and Naoaki Yamanaka<sup>3</sup>, <sup>1</sup>Osaka University, Japan, <sup>2</sup>Osaka City University, Japan, <sup>3</sup>NTT Corporation, Japan*
- 2B-3: xPF: Packet Filtering for Low-Cost Network Monitoring  
*S. Ioannidis<sup>1</sup>, K. G. Anagnostakis<sup>1</sup>, J. Ioannidis<sup>2</sup> and A. D. Keromytis<sup>3</sup>, <sup>1</sup>University of Pennsylvania, USA, <sup>2</sup>AT&T Labs – Research, USA, <sup>3</sup>Columbia University, USA*
- 2B-4: Multi-zone Caches for Accelerating IP Routing Table Lookups  
*I. L. Chvets and M.H. MacGregor, University of Alberta, Canada*

### **The ATM Forum, 6:00 – 7:00 PM (Room A)**

*Chair: Prof. Kenichi Kitami, Tokyo University of Technology, Japan*

*Dr. Richard A. Sweatt,  
Senior Director, Security Visionary - CTO Office, NetScreen Technologies, Inc.  
Americas Marketing Awareness Committee Chairperson, The ATM Forum*

### **Reception, 7:00 – 8:30 PM (Portopia Hotel)**

## Tuesday, May 28, 2002

### **Invited Speech I, 8:30 – 9:15 AM (Room A)**

Chair: Prof. Tatsuro Takahashi, Kyoto University, Japan

#### **Making Light Work of the Future IP Network**

Dr. Ken-ichi Sato, Executive Manager, NTT Network Innovation Laboratories, NTT Corporation, Japan

### **Invited Speech II, 9:15 – 10:00 AM (Room A)**

Chair: Prof. Tatsuro Takahashi, Kyoto University, Japan

#### **Internet Routers and Optical Technology**

Professor Nick McKeown, Stanford University, USA

### **Session 3A: Optical Internet/GMPLS**

**10:30 AM – 12:00 PM (Room A)**

Chair: Prof. Hussein T. Mouftah, Queen's University, Canada

3A-1: Adaptive Virtual Topology Reconfiguration Policy Employing Multi-Stage Traffic Prediction in Optical Internet

Lin Zhang<sup>1</sup>, Kyung-hee Lee<sup>1</sup>, Chan-Hyun Youn<sup>1</sup> and Hwan-Geun Yeo<sup>2</sup>, <sup>1</sup>Information and Communications University, Korea, <sup>2</sup>Net's Feel Ltd., Korea

3A-2: High Performance Network with Merged Optical and IP

Satoru Yamano, Tashiya Okabe, Yoshinobu Oshima, Kenichi Sato, Toshiyuki Kanoh, Shohei Takeuchi, Chie Onuma and Tomohiro Yagyu, NEC Networks, Japan

3A-3: A Study on GMPLS Control Architecture in Photonic IP Networks

Shinya Kano, Toshio Soumiya, Masatake Miyabe and Akira Chugo, Fujitsu Laboratories Ltd, Japan

3A-4: Traffic Engineering and Signaling Technologies in Photonic-GMPLS-Router Networks

Naoaki Yamanaka, Satoru Okamoto, Kohei Shiimoto, Eiji Oki and Wataru Imajuku, NTT Corporation, Japan

### **Session 3B: Switch Router Architecture**

**10:30 AM – 12:00 PM (Room B)**

Chair: Prof. Mounir Hamdi, Hong Kong University of Science and Technology, Hong Kong

3B-1: Dynamic Thresholds for Shared Buffer Switches with Variable Length Packets

Ruey-Bin Yang<sup>1</sup>, Ming-Cheng Liang<sup>2</sup>, Yuan-Sun Chu<sup>1</sup> and Cheng-Shong Wu<sup>1</sup>, <sup>1</sup>National Chung Cheng University, Taiwan, <sup>2</sup>I-Shou University, Taiwan

3B-2: An Edge-based Admission Control for Differentiated Services Network

Bin Pang<sup>1</sup>, Huai-Rong Shao<sup>2</sup>, Wenwu Zhu<sup>2</sup> and Wen Gao<sup>1</sup>, <sup>1</sup>Chinese Academy of Sciences, China, <sup>2</sup>Microsoft Research China

3B-3: Next Generation Carriers Internet Backbone Node Architecture (MSN Type-X)

Michihiko Aoki, Naoaki Yamanaka, Takashi Kurimoto, Takashi Miyamura and Jun Nishikido, NTT Corporation, Japan

3B-4: On Maximum Rate Control of Worst-case Weighted Fair Queueing

Jeng Farn Lee<sup>1</sup>, Yeali Sun<sup>1</sup> and Meng Chang Chen<sup>2</sup>, <sup>1</sup>National Taiwan University, Taiwan, <sup>2</sup>Academia Sinica, Taiwan

### **Panel Discussion, 1:30 – 3:00 PM (Room A)**

#### **Next Generation Mobile Internet Technology**

Organizer and Chair: Professor Takeshi Hattori, Sophia University, Japan

Panelists: TBA

### **Interactive Demonstration Overview, 3:00 – 3:15 PM (Room A)**

Tadanobu Okada, NTT Network Service Systems Laboratories, NTT Corporation, Exhibition Chair

## Tuesday, May 28, 2002

### Poster Session, 3:15 – 5:00 PM (Event Hall)

- P-1: Fuzzy Early Discard (FED) to Improve TCP Reno Performance over ATM-UBR  
*YoonTze Chin, Shiro Handa, Fumihito Sasamori and Shinjiro Oshita, Shinshu University, Japan*
- P-2: Single - Anchored Soft Bandwidth Allocation System with Deflection Routing for Optical Burst Switching  
*Timucin Ozugur, Farid Farahmand and Dominique Verchere, ALCATEL Research and Innovation Center, USA*
- P-3: Scheduling Latency-Critical Traffic: A Measurement Study of DRR+ and DRR++  
*C. Zhang and M.H. MacGregor, University of Alberta, Canada*
- P-4: Blocking Probabilities of Multi-Layer Multicast Streams  
*Jouni Karvo, Samuli Aaltro and Jorma Virtamo, Helsinki University of Technology, Finland*
- P-5: Load Distribution-Survivable Lightpath Routing for the Optical Virtual Private Network  
*Chutima Prommak and David Tipper, University of Pittsburgh, USA*
- P-6: Off-line Lightpath Routing in WDM Networks with Different Wavelength Converter Configurations  
*Dominic A. Schupke, Munich University of Technology, Germany*
- P-7: Maximal Reservable Bandwidth Tree - A New Approach to Reduce the Storage of State Information  
*Yu-Kung Ke and John A. Copeland, Georgia Institute of Technology, USA*
- P-8: Class-Based Dynamic Buffer Allocation for Optical Burst Switching Networks  
*Jingxuan Liu and Nirwan Ansari, New Jersey Institute of Technology, USA*
- P-9: Evaluation of the Performance of the Mobile Packet Communications Network  
*Toshihiro Suzuki<sup>1</sup>, Akira Miura<sup>1</sup>, Keiko Yoshihara<sup>1</sup>, Ryutaro Matsumura<sup>2</sup>, Masayuki Inoue<sup>2</sup> and Hiromichi Kawano<sup>2</sup>, <sup>1</sup>NTT DoCoMo Inc., Japan, <sup>2</sup>NTT Corporation, Japan*
- P-10: Hierarchical Optical Switching: A Node-Level Analysis  
*Rauf Izmailov<sup>1</sup>, Aleksandar Kolarov<sup>1</sup>, Ruixue Fan<sup>1</sup> and Soichiro Araki<sup>2</sup>, <sup>1</sup>NEC USA, USA, <sup>2</sup>NEC Corporation, Japan*
- P-11: Delay and Throughput Analysis of the High Speed Variable Length Self-Routing Packet Switch  
*Jingshown Wu, Hsien-Po Shiang, Kun-Tso Chen and Hen-Wai Tsao, National Taiwan University, Taiwan*
- P-12: Queue Management Algorithms and Network Traffic Self-Similarity  
*B. Sikdar, K. Chandrayana, K. S. Vastola and S. Kalyanaraman, Rensselaer Polytechnic Institute, USA*
- P-13: Opportunity-Based Deficit Round Robin: A Novel Packet Scheduling Strategy for Wireless Networks  
*Yunkai Zhou, Madhusudan Hosaagrahara and Harish Sethu, Drexel University, USA*
- P-14: Static Round-Robin Dispatching Schemes for Clos-Network Switches  
*Konghong Pun and Mounir Hamdi, Hong Kong University of Science and Technology, Hong Kong*
- P-15: Hierarchical Path QoS on a QoS-based Multicast Protocol SRSVP  
*Takaaki Sekiguchi<sup>1</sup>, Youichi Koyama<sup>2</sup>, Kenji Fujikawa<sup>1</sup>, Yasuo Okabe<sup>1</sup> and Kazuo Iwama<sup>1</sup>, <sup>1</sup>Kyoto University, Japan, <sup>2</sup>Trans New Technology Inc., Japan*

### Interactive

### Demonstrations

3:15 – 6:30PM  
(Event Hall)

(Floor is open from  
10:00 AM)

See guide in this  
book for detail.

**Tuesday, May 28, 2002**

*Banquet 7:00 – 10:30 PM (Portopia Hotel)*

**Towards Next Generation Internet**

*Prof. Bijan Jabbari, George Mason University, USA*

**HPSR 2002 Award Ceremony**

*Dr. Heinrich J. Stuetgen, NEC Europe, Germany*

**HPSR 2003 in Torino, Italy**

*Prof. Marco Ajmone Marsan, Politecnico di Torino, Italy*

## Wednesday, May 29, 2002

### **Session 4A: Diffserv/IP QoS**

**8:30 – 10:00 AM (Room A)**

*Chair: Prof. Jin Seek Choi, Information and Communication University, Korea*

- 4A-1: Quality of Service Based End-to-End SiMO Routing Framework in Differentiated Services Networks  
*Jian Zhao<sup>1</sup>, Hossam Hassanein<sup>1</sup> and Jieyi Wu<sup>2</sup>, <sup>1</sup>Queen's University, Canada, <sup>2</sup>Southeast University, China*
- 4A-2: Configuration of DiffServ Routers for High-speed Links  
*Albert Banchs<sup>1</sup>, Sandra Tartarelli<sup>1</sup>, Fabrizio Orlandi<sup>1</sup>, Shohei Sato<sup>2</sup>, Kazutomo Kobayashi<sup>2</sup> and Huanxu Pan<sup>2</sup>, <sup>1</sup>NEC Europe Ltd., Germany, <sup>2</sup>NEC Corporation, Japan*
- 4A-3: End-to-End Delay Differentiation of IP Traffic Aggregates using Priority Queuing Models  
*Pedro Sousa and Paulo Carvalho and Vasco Freitas, Universidade do Minho, Portugal*
- 4A-4: A Dynamic Admission Control Scheme in a DiffServ Domain  
*Jin-Cheol Kim and Young-Hee Lee, Information and Communications University, Korea*

### **Session 5A: TCP/IP Flow Control**

**10:30 AM – 12:00 PM (Room A)**

*Chair: Prof. Masayuki Murata, Osaka University, Japan*

- 5A-1: Evaluation of a Controlled Shared Backup Mechanism  
*Jim M. Ng and Ruth N. Susilo, Nanyang Technological University, Singapore*
- 5A-2: Optimum UDP Packet Sizes in Ad Hoc Networks  
*JangYeon Lee<sup>1</sup>, GyeYoung Kim<sup>2</sup> and SungKwon Park<sup>2</sup>, <sup>1</sup>Korea Electronics Technology Institute, Korea, <sup>2</sup>Hanyang University, Korea*
- 5A-3: Optimized Feedback Design for Backpressure-based Fairness Control  
*Yoshiyuki Hamaoka, Junichi Murayama and Kazuhiro Matsuda, NTT Corporation, Japan*
- 5A-4: Comparative Study of TCP Compatible Binomial Congestion Control Schemes  
*K. Chandrayana, B. Sikdar and S. Kalyanaraman, Rensselaer Polytechnic Institute, USA*

### **Session 4B: Optical Switch**

**8:30 – 10:00 AM (Room B)**

*Chair: Prof. Kenichi Yukimatsu, Akita University, Japan*

- 4B-1: Upstream Resource Management Propagation Algorithm for Optical Burst Switching  
*Timucin Ozugur and Dominique Verchere, ALCATEL Research and Innovation Center, USA*
- 4B-2: Efficient Channel-Scheduling Algorithm in Optical Burst Switching Architecture  
*Jin-Bong Chang and Chang-Soo Park, Kwang-Ju Institute of Science and Technology, Korea*
- 4B-3: Generalized Recursive Network: A New Architecture for Nonblocking Optical Multistage Interconnection Networks  
*Md. Mamun-ur-Rashid Khandker, Xiaohong Jiang, Susumu Horiguchi and Hong Shen, Japan Advanced Institute of Science and Technology, Japan*
- 4B-4: Dynamic Deficit Round-Robin Scheduler for 5-Tb/s Switch Using Wavelength Routing  
*Kimihiro Yamakoshi, Eiji Oki and Naoaki Yamanaka, NTT Corporation, Japan*

### **Session 5B: Switch Architecture/Scheduling II**

**10:30 AM – 12:00 PM (Room B)**

*Chair: Dr. Aleksandra Smiljanic, AT&T Labs, USA*

- 5B-1: Performance Study of an Input Queueing ATM Switch with Windowing Scheme for IP Switching System  
*Jin Seek Choi, Information and Communications University, Korea and Hyeong Ho Lee, Electronics and Telecommunications Research Institute, Korea*
- 5B-2: A Scalable and Fully Distributed Architecture for Ethernet Switching  
*Marc Herbert<sup>1,2</sup>, Pascale Primer<sup>1</sup>, Bernard Tourancheau<sup>2</sup> and Laurent Lefevre<sup>1</sup>, <sup>1</sup>Laboratoire RESAM - INRIA RESO, France, <sup>2</sup>SUN Labs Europe, France*
- 5B-3: High Throughput Multicast Solution for Shared Memory Packet Switch  
*Kang Xi, Ning Ge and Chongxi Feng, Tsinghua University, China*
- 5B-4: Multipath Packet Switch Using Packet Bundling  
*Michael Berger, Technical University of Denmark, Denmark*

### **Closing, 12:00 – 1:00 PM (Room A)**

*Chair: Prof. Kenichi Kitami, Tokyo University of Technology, Japan*

## Interactive Demo Exhibitor List (Preliminary)

Affiliations	Title of the Demonstration
Agilent Technologies	RouterTester 900/Distributed Network Analyzer VQT/Multi-rate 10 G Tester
Anritsu Corporation	IP Traffic Performance Test for Video System/43.5 Gbps BERT System
Association of Super-Advanced Electronics Technologies (ASET)	Opto-electronics Packaging Technology for the last 1 m
Erlang Technology	Erlang 40 Gb/s Full-duplex Multi-services Router Reference System
Fujitsu Laboratories LTD.	Acousto-Optic Tunable Filter (AOTF)
Hitachi, Ltd.	RHiNET-3/SW: High Performance Optical Network Switch for Parallel Computing Environment
Japan Aviation Electronics Industry, Limited	Small 4 Channel 2 x 2 MEMS Optical Switch
NEC Networks	High Performance Demonstration in Optical-IP Merged Network
NTT Access Network Service Systems Laboratories, NTT Corp.	IEEE 802.11a-Compliant High-Speed Wireless LAN
NTT Electronics Corporation	Reliable PLC Thermo-Optic Switches for Optical Network Systems
NTT Network Service Systems Laboratories, NTT Corp.	High-speed core router, Type-X
OKI Electric Industry Co., Ltd.	xDSL on Fiber system (Art Fiber system)
Spirent/TOYO/NTT-AT	Performance evaluation of Layer 3 switch using SmartBits and evaluation of router's convergence using AX/4000
VITESSE	PaceMaker™: OC-48 Traffic Management Engine Demo

## Tutorials

### Sunday May 26

#### **Tutorial 1:** 12:30 - 15:30

"Scheduling algorithms for input-queue IP routers"

*Marco Ajmone Marsan* (Politecnico di Torino)

*Paolo Giaccone*

#### **Tutorial 2:** 12:30 - 15:30

"Peer-to-peer communications"

*Takashige Hoshiai* (NTT)

#### **Tutorial 3:** 16:00 - 19:00

"Mobile Internet and Next Generation Wireless Networks"

*Abbas Jamalipour* (U. of Sydney)

#### **Tutorial 4:** 16:00 - 19:00

"IP over WDM"

*Hussein T. Mouftah* (Queen's Univ)

### **Tutorial 1: Scheduling algorithms for input-queue IP routers**

Sunday May 26, 12:30 - 15:30

#### **Tutor**

Marco Ajmone Marsan (Politecnico di Torino)

Paolo Giaccone

#### **Syllabus**

This tutorial discusses the issues involved in the design of schedulers for input-queued switching matrices, within high-performance IP routers.

The goal of the tutorial presentation is to first illustrate the motivations for input-queued switching matrices controlled by simple and efficient scheduling algorithms within high performance routers, and then overview some of the most significant scheduling algorithms that were recently proposed in the technical literature.

The performances of all overviewed schemes are discussed through numerical simulation results as well as theoretical statements about their stability properties.

The tutorial is destined to researchers in the field, as well as designers of high speed router architectures.

#### **Profile**

Marco Ajmone Marsan is a Full Professor at the Electronics Department of Politecnico di Torino, in Italy. He holds degrees in Electronic Engineering from Politecnico di Torino and University of California, Los Angeles. Since November 1975 to October 1987 he was at the Electronics Department of Politecnico di Torino, first as a Researcher, then as an Associate Professor. Since November 1987 to October 1990 he was a Full Professor at the Computer Science Department of the University of Milan, in Italy.

During the summers of 1980 and 1981 he was with the Research in Distributed Processing Group, Computer Science Department, UCLA.

During the summer of 1998 he was an Erskine Fellow at the Computer Science Department of the University of Canterbury in New Zealand. He has coauthored over 300 journal and conference papers in the areas of Communications and Computer Science, as well as the two books "Performance Models of Multiprocessor Systems" published by the MIT Press, and "Modeling with Generalized Stochastic Petri Nets" published by John Wiley.

He received the best paper award at the Third International Conference on Distributed Computing Systems in Miami, Fla., in 1982.

His current interests are in the fields of performance evaluation of communication networks and their protocols. He currently serves

# Tutorials

on the editorial boards of the IEEE/ACM Transactions on Networking; the Optical Networks Magazine; the Photonic Network Communications Journal; the Wireless Communications and Mobile Computing Journal.

He was a keynote speaker at IPCCC 98 and ITC 17. M. Ajmone Marsan is a Fellow of IEEE.

Paolo Giaccone holds a Post-Doc position at the Electronics Department of Politecnico di Torino, in Italy. He obtained Laurea and Ph.D. degrees in Telecommunications Engineering from Politecnico di Torino in 1998 and 2001, respectively. During the summer 1998, he visited the High Speed Networks Research Group at Lucent Technology, Holmdel. During 2000-2001, he visited the research group of Prof. Prabhakar at Stanford University.

He was teaching assistant for the classes "Packet switch architectures I" and "Packet switch architectures II" (Winter and Spring Quarters, 2001) at Stanford University.

His Ph.D. research was mainly focused on the design of scheduling algorithms for input-queued switches; in particular he devised the class of learning scheduling algorithms and studied the support of multicast traffic. P. Giaccone is a member of IEEE.

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## **Tutorial 2: Peer-to-peer communications**

Sunday May 26, 12:30 - 15:30

### **Tutor**

Takashige Hoshiai (NTT)

### **Syllabus**

Gnutella's announcement in March 2000 stirred worldwide interest by referring to a P2P model. Basically, the P2P model needs not the broker?the centralized management server?that until now has figured so importantly in prevailing business models, and offers a new approach that enables peers such as end terminals to discover out and locate other suitable peers on their own without going through an intermediary server.

This tutorial explains P2P concepts and visions from the viewpoints of P2P history and dimension model.

Takashige Hoshiai proposed a Brokerless Model (similar to P2P model) back in 1998, based on SIONet (Semantic Information-Oriented Network) as the implementing technology. Prototype version a of SIONet was developed in 1998, followed by prototype version b in 1999, and versions 1.0 SIONet in the year 2000.

SIONet is essentially a meta network based on an autonomous decentralized collaboration scheme. In contrast to conventional networks that require a destination address for packets to reach their proper destinations, packets are delivered in SIONet based on semantic information.

This enables entities to discover for and zero in on other specific entities in the vast sea of distributed non-specific entities that are connected to the Internet. This tutorial explains SIONet technologies and makes a demonstration using SIONet prototype

### **Profile**

Takashige Hoshiai is a senior research scientist supervisor at NTT Network Innovation Laboratories, in Japan. He holds a Ph.D. degree in Communications and Systems from The University of Electro-Communications, Japan.

His research areas are distributed systems, distributed object technologies, real-time systems, agent systems and P2P. Since he proposed Brokerless model in 1998, especially, he has studied SIONet architecture that is a solution of P2P platforms.

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## **Tutorial 3: Mobile Internet and Next Generation Wireless Networks**

Sunday May 26, 16:00 - 19:00

### **Tutor**

Abbas Jamalipour (U. of Sydney)

### **Syllabus**

This tutorial explains implementation and performance issues of future mobile Internet architectures over next generation wireless cellular systems. Internet-based applications are emerging source of traffic in future telecommunication networks and hence, broadband wireless networks should consider the Internet as one of the dominant services for the near future. In this context, evolution of fixed Internet into mobile environment is becoming the main topic for research and development in respected academia and industry and will remain for many years from now. The tutorial explains current and future mobile and wireless Internet technologies, and directs up-to-date trends of the two leading technologies; i.e. Internet and cellular, into next generation wireless networks such as UMTS/IMT-2000, wideband CDMA, and beyond. The tutorial gives audiences all knowledge they need to start and/or continue research and development projects and to plan for wired and wireless IP networking.

#### **1. Development of wireless telecommunication networks**

Presentation of statistics on wireless communications growth, technical trends, architecture of current small version wireless IP including WAP, HSCSD, CDPD, i-Mode, and FOMA

#### **2. Trends in wireless cellular networks toward wireless IP**

Review of UMTS network architecture, UTRAN, UMTS trends and requirements, UMTS open service architecture, and virtual home environment

#### **3. Standardization of third generation systems**

Introducing standardization bodies for 3G and wireless IP, 3GPP and 3GPP2, MWIF, and G3G specifications and reports, review of 3G radio access standards, harmonization

#### **4. Enhanced general packet radio services (EGPRS)**

GPRS network architecture and EGPRS, protocols, tunneling and mobility management

#### **5. Beyond third generation systems**

Characteristics of beyond 3G systems, all IP network, and the new layered architecture

# Tutorials

## 6. QoS in wireless IP networks

QoS requirements, challenges in QoS management for wireless channel, QoS provisioning challenges, GPRS QoS support, IP QoS support such as IntServ and DiffServ

## 7. Protocol stack changes toward wireless IP (TCP)

Problems and deficiencies of TCP on wireless link, solutions for cellular and satellite systems

## 8. Protocol stack changes toward wireless IP (IP)

Why IP version 6, protocol overview, transition issues from IPv4, review of current status

## 9. Mobile IPv6

Introduction to the protocol, security and mobility management in MIPv6

## 10. Wireless IP in 3G systems based on IETF Protocols

Network models and architectures for wireless IP in accordance with 3G systems, entities and network layers, interfaces, mobility management issues for wireless IP and cellular

## 11. Open research topics and references

Information on open research topics in the field and references for further study

### Profile

*Abbas Jamalipour* has been with the School of Electrical and Information Engineering at the University of Sydney, Australia, since 1998, where he is responsible for teaching and research in wireless data communication networks and satellite systems. He holds a Ph.D. degree in Electrical Engineering from Nagoya University, Japan. His current areas of research include wireless broadband data communications and wireless IP networks, mobile and satellite communications, traffic modeling and congestion control. He is recipient of a number of technology and paper awards and has authored two technical books and coauthored two others. He has authored numerous publications in these areas, and given short courses and tutorials in major international conferences. He has served on several major conferences technical committees, and organized and chaired many technical sessions and panels in international conferences including a symposium in IEEE Globecom 2001. He is the Secretary to the Satellite and Space Communications Committee of the IEEE ComSoc and has served as a guest editor to two special issues on 4G networks in IEEE magazines. He is a technical editor to the IEEE Wireless Communications Magazine (formerly, Personal Communications Magazine) and a Senior Member of IEEE.

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### Tutorial 4: IP over WDM

Sunday May 26, 16:00 - 19:00

### Tutor

Hussein T. Mouftah (Queen's Univ)

### Syllabus

The emergence of Wavelength Division Multiplexing (WDM) technology has provided a new dimension for exploiting the huge capacity of optical fibers. WDM allows multiple optical signals to be transmitted simultaneously and independently in different optical (wavelength) channels over a single optical fiber and thus provides enormous bandwidth at the physical layer. With IP becoming the dominant network-layer technology for global networks, IP internetworking over WDM networks is becoming increasingly important. In order to fully utilize WDM Network capabilities, we have to develop new architectures and network control methods to import IP traffic into WDM highways while providing Quality of Service management in a cost effective way. We will discuss these issues and present the control models of IP-optical network interaction. We will also present the Generalized Multi Protocol Label Switching (GMPLS) and the role it can play in this area.

Network survivability has been a crucial concern in WDM optical networking. To survive different types of network failures, a variety of optical protection and restoration schemes have been proposed. We will address this issue and present different optical protection and restoration schemes within wavelength-routed WDM mesh networks. We will cover dedicated and shared protection schemes including path and link shared protection, short leap shared protection, as well as channel protection.

The deployment of wavelength converters within optical switches provides robust routing, switching and network management in optical layer, which is critical to the emerging all-optical Internet. However, the high cost of wavelength converters at current stage of manufacturing technology has to be taken into consideration when we design node architectures for an optical network. We will discuss the efficiency of wavelength converters in a long-haul optical network at different degrees of traffic load. Also, we will describe cost-effective ways to optimally design wavelength-convertible switch so as to achieve higher network performance while still keeping the total network cost down.

We will describe routing and wavelength assignment (RWA) algorithms and their use in the design of WDM networks with and without wavelength converters.

### Profile

Hussein Mouftah joined the Department of Electrical and computer Engineering at Queen's University in 1979, where he is now a Full Professor and the Department Associate Head, after three years of industrial experience mainly at Bell Northern Research of Ottawa (now Nortel Networks). He has spent three sabbatical years also at Nortel Networks (1986-87, 1993-94, and 2000-01), always conducting research in the area of broadband packet switching networks, mobile wireless networks and quality of service over the optical Internet. He served as Editor-in-Chief of the IEEE Communications Magazine (1995-97) and IEEE Communications Society Director of Magazines (1998-99). Dr. Mouftah is the author or coauthor of two books and more than 600 technical papers and 8 patents in this area. He is the recipient of the 1989 Engineering Medal for Research and Development of the Association of Professional Engineers of Ontario (PEO). He is the joint holder of a Honorable Mention for the Frederick W. Ellersick Price Paper Award for Best Paper in Communications Magazine in 1993. Also he is the joint holder of the Outstanding Paper Award for a paper presented at the IEEE 14th International Symposium on Multiple-Valued Logic. He is the recipient of the IEEE Canada (Region 7) Outstanding Service Award (1995). Dr. Mouftah is a Fellow of the IEEE (1990).

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Registrants are kindly requested to complete this registration form and to submit it by April 26, 2002 for early registration. If you have any questions about the submission, please contact the Secretariat of HPSR 2002:

C/O: The IEICE(the Institute of the Electronics, Information and Communication Engineers)

Attn.: Mr. Y. Uchida / Mr. Y. Motoyama

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## Conference fee

Please check the appropriate boxes. Conference Fees include a copy of the proceedings (copies of speakers' slides), coffee, and Banquet.

	Early Registration (received by April 26, 2002)	Late/Onsite Registration (April 27, 2002 or later)
Membership	<input type="radio"/> 54,000 yen	<input type="radio"/> 70,000 yen
Non-Member	<input type="radio"/> 64,000 yen	<input type="radio"/> 80,000 yen
Student	<input type="radio"/> 9,000 yen (without Banquet)	<input type="radio"/> 15,000 yen (without Banquet)
	<input type="radio"/> 14,000 yen (with Banquet)	<input type="radio"/> 20,000 yen (with Banquet)

Note: Extra Banquet fee is 5,000 yen. HPSR 2002 can issue the receipts respectively.

## Tutorial fee

- Tutorial 1 (Scheduling algorithms for input-queued IP routers)**
- Tutorial 2 (Peer-to-peer communications)**

	Early Registration (received by April 26, 2002)	Late/Onsite Registration (April 27, 2002 or later)
Membership / Non-Member	<input type="radio"/> 12,500 yen	<input type="radio"/> 15,000 yen
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- Tutorial 3 (Mobile internet and next generation wireless networks)**
- Tutorial 4 (IP over WDM)**

	Early Registration (received by April 26, 2002)	Late/Onsite Registration (April 27, 2002 or later)
Membership / Non-Member	<input type="radio"/> 12,500 yen	<input type="radio"/> 15,000 yen
Student	<input type="radio"/> 3,000 yen	<input type="radio"/> 3,500 yen